Assessment of Economic Benefits and Costs of Marine Managed Areas in Hawaii

----- Executive Summary -----

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30 April 2004

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Colophon

This executive summary combines the research results from a number of papers carried out under the study "Assessment of Economic Benefits and Costs of Marine Managed Areas in Hawaii". The studies were contracted out to Cesar Environmental Economics Consulting (CEEC) and funded by the National Oceanic and Atmospheric Administration, Coastal Ocean Program, under awards NA 160A2412 to the University of Hawaii for the Hawaii Coral Reef Initiative Research Program. Co-funding was obtained from the Division of Aquatic Resources (DAR) and the Department of Business, Economic Development & Tourism (DBEDT). The studies included a paper on the fisheries benefits of MMAs (Friedlander and Cesar, 2004), a write-up of the recreational survey at the MMA sites (Van Beukering and Cesar, 2004), a background on the institutional/regulatory framework om MMAs in Hawaii (Cesar, 2004), a paper on the economic value and cost-benefit analysis of management options for MMAs (Van Beukering and Cesar, 2004) and a paper on the international experience of sustainable financing of MMAs (Cesar and van Beukering, 2004).

Introduction

In recent years, there has been growing interest in marine protected areas as a tool for conserving and managing coral reef ecosystems, because of their perceived benefits. This has resulted, for instance, in the establishment of an ever-increasing number of Marine Protected Areas (MPAs) globally. The US Coral Reef Task Force has articulated its goal of establishing 20% of representative habitat types as marine protected areas by the year 2010, and has recognized the need for this type of ecosystem management.

Marine protected areas (MPAs) have been referred to as reserves, no-take zones, sanctuaries, marine parks and marine managed areas to name but a few. In order to highlight the fact that there is more to management of these areas than protection and conservation, this paper will refer to these areas as Marine Managed Areas (MMAs).

The benefits of MMAs have so far been largely described in qualitative terms. They include (i) biodiversity conservation; (ii) protection of habitats attractive to tourism; (iii) increased productivity of fisheries; (iv) increased knowledge of marine science; (v) refuge for intensely exploited fish and invertebrate species, and (vi) protection of cultural diversity e.g. sacred places, wrecks and lighthouses. The costs are divided into initial investments, enforcement and operational costs. Recent estimates suggest that the fisheries benefits of MMAs could in fact be substantial (Roberts et al. 2001). The potentially large tourism benefits have been recognized for a substantially longer period of time. For Hawaii, the asset value of its coral reefs was recently estimated at US$10 billion (Cesar and van Beukering, 2004), the majority of this being from tourism.

The overall economic dimension of MMA establishment and management in Hawaii is, however, still poorly understood. This is especially true with regards to quantification of the benefits of MMAs. This study aims to address this issue, by evaluating the economic value of 6 selected MMAs in Hawaii. It will also include the costs and benefits of their various management and financing regimes. These sites are: Hanauma Bay and Waikiki Diamond Head, both on Oahu; Molokini and Honolua on Maui, and Waiopae and Kahaluu on Big Island.

The study is relevant for different audiences: Firstly, by illustrating the economic and societal benefits of establishing MMAs, it provides policy-makers with powerful justification for government investment in MMAs. Secondly, through analysis of the various management options for MMAs, this study can assist MMA managers in the design of feasible management plans. Thirdly, benefit estimates for ecosystem goods and services provide crucial information for stakeholder consultations. Fourthly, the questions of how to make MMAs potentially self-financing, and how to pay for enforcement are addressed. Finally, the integration of ecological and economic research methods may provide the academic community with an example on which they can build.

Five studies were carried out under this research project. They address the: (i) fisheries benefits of MMAs in Hawaii; (ii) economic value and cost benefit analysis of management options; (iii) institutional/regulatory framework of MMAs in Hawaii; (iv) recreational survey of active reef users in Hawaii; and (v) sustainable financing of MMAs with descriptive case studies from around the world. This executive summary highlights the main findings and recommendations from these 5 studies.

Recreational Survey

A total of 532 divers,771 snorkelers and 77 non-users were interviewed using a structured self-administered questionnaire. In the survey, respondents were asked what they would be willing to pay (WTP) as a coral reef conservation fee, on top of the amount that they are already paying in terms of standard expenditures (e.g. dive equipment, boat fee, tanks, instructor). Figure 1 shows the distribution of the respondents' WTP extra for conservation. Less than 25% indicated that they would be unwilling to pay anything extra for reef conservation. Excluding non-payers, the average payment of the respondents is $3.77 per experience. Including non-payers, this average amounts to $2.81. Divers have a slightly higher WTP than snorkelers (i.e. 8%). When asked how they feel about paying extra, the large majority of respondents feel good about contributing to conservation. Only between 8 and 9% of the users would actually refrain from the activity if a user fee was introduced.

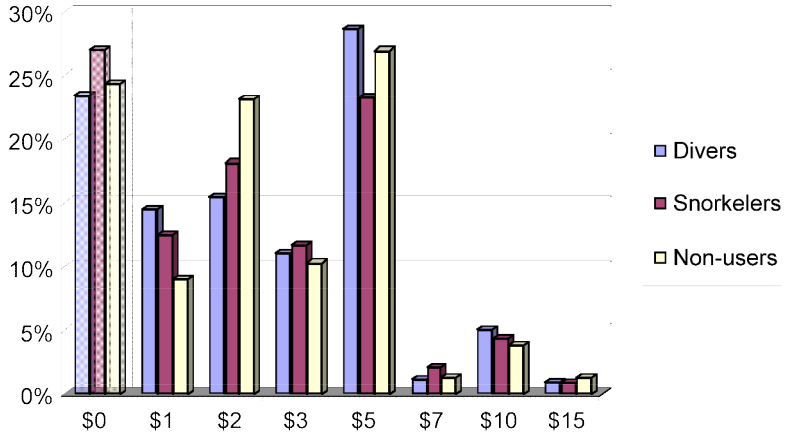

Figure 1: Distribution of WTP per activity for conservation program

Table 1 shows the significant variation in the degree of zero-bidders across nationalities. Hawaiian respondents are most clearly opposed to a conservation contribution, which is logical given that they already pay taxes that are partly spent on coastal management. In addition, some Hawaiians consider it a birthright to have free access to the ocean and its reefs. Typically, the most agreeable group is the Mainland US citizen of which almost 80% is willing to pay extra for conservation. Being temporary users of the reef, they consider it normal to contribute to conservation.

Table 1: Conservation willingness breakdown by nationality

Country	No	Yes
Hawaii	45%	55%
Mainland US	21%	79%
Canada	26%	74%
Japan	38%	63%
Rest of Asia	20%	80%
United Kingdom	23%	77%
Europe (excl. UK)	30%	70%
Elsewhere	33%	67%

Figure 2 shows the motivation of zero-bidders for being unwilling to pay for conservation. The majority of the users feel that it is government's responsibility to manage the marine environment, not individuals. Another important reason for not being willing to pay is the fact that most respondents do not want the additional financial burden.

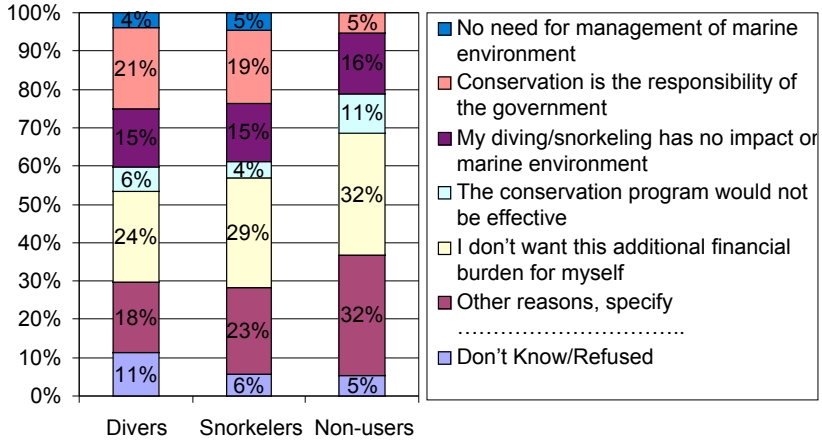

Figure 2: Motivation for zero WTP for conservation

The majority of respondents thought that, if introduced, the user fee system should be mandatory (52% of all snorkelers), rather than voluntary (43% of all snorkelers). Respondents were also asked who they trust most to collect and allocate the funds for marine management in Hawaii. The public sector proved to be the most trusted organization to collect and allocate the funds (i.e. 30%). Snorkelers and divers do not think very differently on this issue. 19% of respondents trusted NGOs e.g. The Nature Conservancy and the Sierra Club, to play a role in the collection and allocation of the funds. Local communities and the private sector are not particularly popular as intermediaries between donors and beneficiaries (i.e. 12% and 10% respectively).

Fisheries Benefits of MMAs in Hawaii

As is the case elsewhere in the world, coastal fisheries in Hawaii are facing unprecedented overexploitation. Fishing pressure on nearshore resources in heavily-populated areas of the main Hawaiian Islands (MHI) appears to exceed the capacity of these resources to renew themselves. Factors contributing to the decline of inshore fisheries in the MHI include a growing human population, destruction or disturbance of habitat, introduction of new fishing techniques (inexpensive monofilament gill nets, SCUBA, spear guns, power boats, sonar fish finders), and loss of traditional conservation practices.

Despite the opinion of many fishermen that overharvesting is one of the major reasons for the long-term decline in inshore marine resources, there is poor compliance with state fishing laws. Failures in management can be linked to uncertainties resulting from incomplete knowledge of populations, communities, and ecosystems. Many management tools—including size limits, gear limits, quota systems on effort or total catch, and even temporary closures—are used frequently but do not create a refuge for populations, habitats, and ecosystems, nor do they reallocate fishing effort across space. For decades theoretical evidence has been available on policies that scale back fishing rates when abundance drops. One means for achieving a constant escapement-like policy

is the use of marine reserves to protect part of the stock. Fishing is important to many coastal states and if Hawaii chooses to pursue this sector, MMAs will be needed to reduce the risk of collapse, and rebuild stocks. Table 2 shows a comparison of fish biomass for the Waikiki Diamond Head area with a Marine Life Conservation District (MLCD), a Fisheries Management Area (FMA) and an 'open area'. Both in terms of number of species, abundance and biomass, the two management regimes scored much higher than the 'open area'.

Table 2: Comparison of fish biomass among various management regimes in macroalage habitats in the Waikiki-Diamond Head area.

Management	Mean (SD)	Statistics	P
Marine Life Conservation District (MLCD)	0.22 (0.25)	12.05	0.003
Fisheries Management Area (FMA)	0.11 (0.11)		
Open Access	0.03 (0.02)		

Benefits of MPAs include: (i) increased stock abundance; (ii) preservation of desirable traits; (iii) provision of spillover of adults and juveniles into fished areas; (iv) increased reproductive output and recruitment inside and outside the reserve; (v) insurance against uncertainty; (vi) reduced overfishing by controlling fishing mortality (Sladek Nowlis and Bollermann 2002); (vii) ecosystem management; (viii) maintenance system productivity; and (ix) provision of unfished reference areas.

However, to make MMAs effective in Hawaii, the following actions need to be taken:

- Larger in size – individual reserves should cover 5-10 km^2
- Incorporate essential fish habitat – areas of high habitat complexity, spawning locations, and essential feeding areas need to be represented fully in reserve design
- More connection between shallow and deep habitats – identify juvenile and adult habitats and provide connections for ontogenetic movement
- More connections between resting and feeding habitats. Identify feeding corridors to connect habitats.
- Reserves should be networked. Several smaller reserves may be more beneficial than one large one particularly when one is concerned with limiting the exposure at the boundaries.
- Develop a more ecosystem-based ahupua‘a concept that includes shoreline and upland ecosystems and uses
- Recognize that the baseline of fish populations has shifted downward and manage to rebuild not to sustain current levels of abundance.
- Develop monitoring programs that stratify by habitat types and examine human use patterns.
- Involvement of local communities is invaluable to the creation and implementation of reserves or reserve networks because they play an important role in the enforceability and social acceptability of reserves.

Cost Benefit Analysis of MMA Management

For each of the six MMA sites, a package of management improvements was considered in addition to current effort. This package consists of: (a) services, i.e. basic facilities, such as restrooms, showers and waste-bins with regular trash pick-up; (b) enforcement/compliance; (c) education/ awareness; (d) assessment/monitoring; and (e) infrastructure, such as parking facilities, small piers, mooring buoys, etc. The management cost of this hypothetical package for each site is presented in Table 3, varying from the education center in Hanauma Bay to a small mixed package of enforcement, education and service among others for Waiopai.

Table 3 Summary of annual costs over time and aggregated/discounted costs *

	Hanauma	Diamond Head	Molokini	Honolua	Kahalu'u	Waiopae
Investments						
enforcement	-	40,000	125,000	25,000	35,000	20,000
monitoring	-	10,000	-	-	20,000	-
education	13,500,000	20,000	25,000	15,000	30,000	10,000
service	-	30,000	-	25,000	25,000	25,000
infrastructure	-	5,000	-	50,000	50,000	25,000
Total investment	13,500,000	105,000	150,000	115,000	160,000	80,000
Recurrent costs	-					
enforcement		30,000	70,000	125,000	15,000	10,000
monitoring	-	7,500	-	-	10,000	5,000
education	500,000	10,000	20,000	5,000	10,000	5,000
service	-	10,000	-	5,000	5,000	5,000
infrastructure	-	500	-	5,000	10,000	10,000
Total recurrent	500,000	58,000	90,000	140,000	50,000	35,000
NPV overall	22,317,187	1,127,963	1,807,183	2,617,841	950,657	654,460

* discount rate 3%, period 25 years.

Benefits are determined through the data collected during the recreational survey, as well as with economic data from the HCRI-year 4 study on economic valuation. They were obtained by aggregating the values for tourism, fisheries and educational spillover. Figure 3 shows the composition of the net-benefits calculated for the different sites. It shows the "with" and "without" extra management scenarios for the six MMAs. Least variation is observed in the "without" scenario. Only in the case of Molokini and Kahalu'u will the absence of additional management lead to a decline in overall benefits. This is mainly due to the fact that less visitors are tempted to visit these sites, while those that do, are more frequently disappointed about the deteriorating quality of the reefs. This leads to a lower consumer surplus and willingness to contribute to conservation efforts. The other sites are assumed to maintain the present level of visitors and benefits.

As shown in Figure 3, the "with" additional management scenarios show considerable variation. The highest growth in overall benefits is achieved in Waiopae and Diamond Head. Although these sites are not the most economically valuable MMAs, they hold the largest potential for improvement because their current level of management is limited. Sites such as Hanauma and Molokini have much less potential to develop further. Management improvements have already been implemented, thereby limiting significant

future potential growth of the economic gains. Therefore, the benefits curves of Hanauma and Molokini gradually stabilize over time.

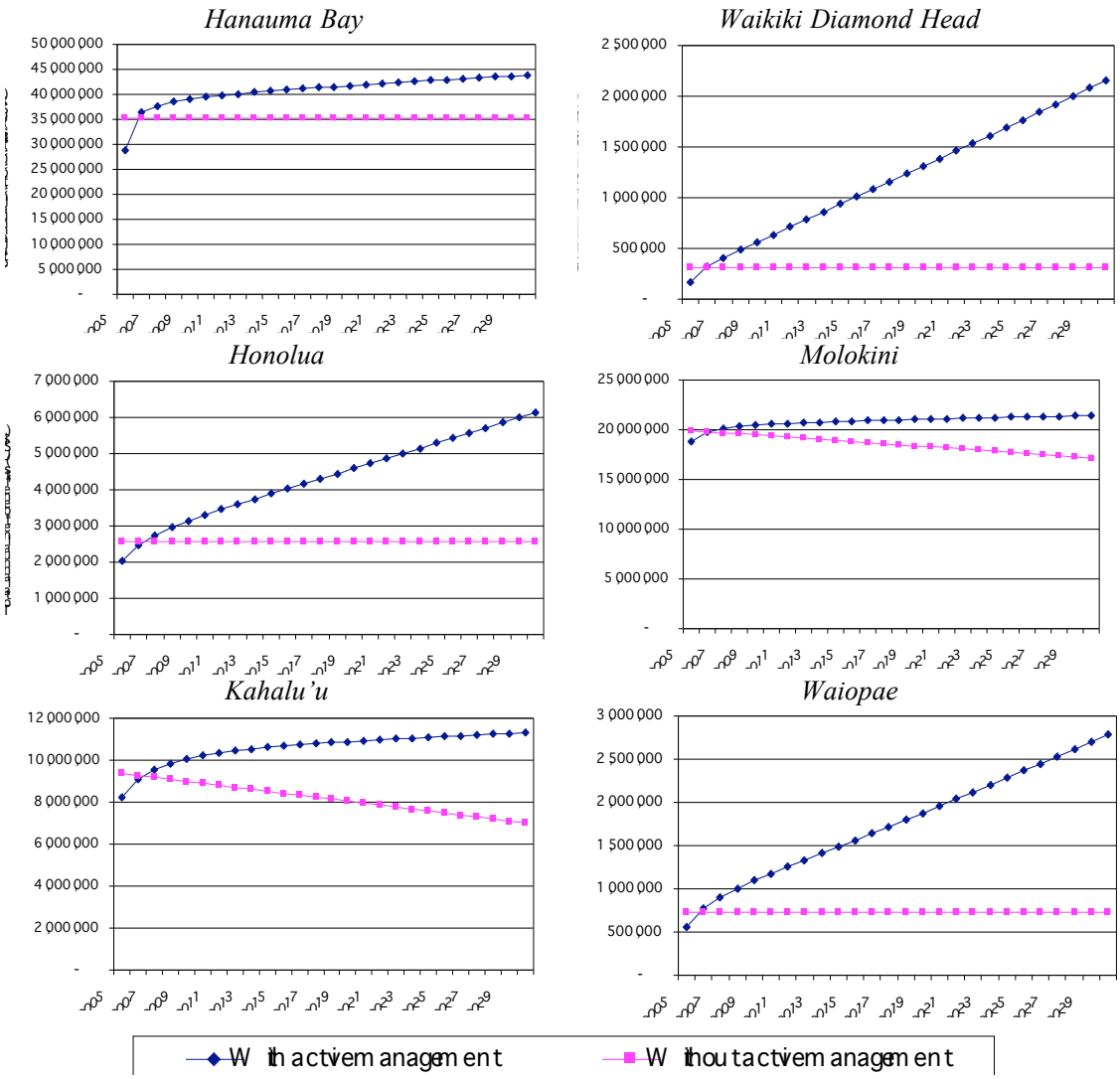

Figure 3 Net-benefits over time (period 2005 till 2030)

Table 4 below shows the gross benefits accumulated over time (net present value) at a discount rate of 3 percent. Hanauma Bay is by far the most economically valuable site from a marine-environmental perspective. The economic importance of the marine environment of Waikiki Diamond Head is minimal compared to Hanauma Bay. Second in value is Molokini. Kahalu'u is the third most valuable site in Hawaii. Clearly, the number of visitors strongly determines the overall value of the MMA.

*Table 4: Economic value in Net Present Value terms (million US$) with and without additional MMA management**

	Hanauma	Diamond Head	Molokini	Honolua	Kahalu'u	Waiopae
With management	732	21	383	78	193	30
Without management	648	6	345	47	154	13
Difference (net benefit)	84	15	38	30	39	17

* discount rate of 3%, period of 25 years.

Sustainable Financing

The economic analysis showed that from an economic welfare perspective, the MMA management options were favorable. However, there are often political forces preventing implementation of these options. The main challenge for MMAs is therefore, how to finance these management options even if the investments are justified from an economic perspective. We have focused on one specific tool, i.e. the introduction of a user fee or entrance fee. Some user fees can be very high, such as the $100 charge for entrance to the Galápagos National Park in Ecuador. The objectives of user fees can be: (i) cost recovery; (ii) generation of "profit,"; (iii) generation of local business opportunities; (iv) provision of maximum opportunities for learning and appreciation of the natural resource; and (v) visitor management to reduce congestion and/or ecological damage.

The National Park Service in the US has expanded its fee collection under the authority of the Recreational Fee Demonstration Project. Yet, there is still no entrance fee at some of the most well-known National (Marine) Parks in the US, such as the Channel Islands National (Marine) Park in California and the Dry Tortugas National Park in Florida.

One of the main impediments to successful implementation of user fees in a marine setting is fee collection. Depending on ease of access, a user fee system can be regulated through a booth at the point of entry (Hanauma Bay), as is the case for most terrestrial parks. Alternatively, it can be managed through the dive industry, where operators are responsible for fee collection (Ras Mohamed in Egypt, Bonaire, Palau), while in Kenya, rangers of the Kenya Wildlife Service collect the fee by boat at the snorkel and dive sites within the MMAs.

To evaluate these user fees in the Hawaiian setting, the financial cost benefit ratio is presented. This ratio differs from the economic cost-benefit ratio. A financial cost benefit ratio of a user fee for an MMA compares the costs of the management option for a site with the collected fee (i.e. the financial benefit) for that site. The financial cost benefit ratio is the ratio of these collected fees over time to the management costs. We have looked at three different user fees. One is the fee corresponding to the average willingness-to-pay value as calculated from the survey data for each site. The other two user fees are flat fees of $1 and $2. For Hanauma and Molokini, only a fee for non-Hawaiian residents was analyzed, while for the other sites, across-the-board fees were considered. Besides these entrance fees, we have also looked at parking fees, which are levied on both residents and 'others' (non-discriminatory). The financial benefit-cost ratios for the three types of user fees, as well as the economic benefit-cost ratio from the previous section are summarized in Table 5. This table also gives the so-called 'break-even user fee'. This is the fee at which management costs are exactly covered by the fee (no profit and no loss).

*Table 5 Economic indicators**

Management	Hanauma	Diamond Head	Molokini	Honolua	Kahalu'u	Waiopae
Financial BC ratio ($1)	0.8	-	2.1	0.8	6.1	2.0
Financial BC ratio ($2)	1.5	-	4.1	1.6	12.1	4.0
Financial BC ratio (WTP)	2.8	-	8.8	2.4	17.6	5.8
Economic BC ratio	3.8	12.5	20.2	10.6	40.5	25.1
Break-even user fee	1.5	-	0.51	1.24	0.17	0.50

* Discount rate 3%, period over 25 years.

As previously discussed, it may be easier to collect the user fees at some sites than at others. However, given the low break-even user fees, a collection system could be envisaged where fees are levied in MMAs where it is easy to administer them, and where the percentage of people who would refuse to pay is very small. The revenues from this fee system could be used, not only for that particular MMA site, but also to subsidize management of MMAs where fee collection is cumbersome or impossible to implement. This could be an interesting first step towards integrated ecological and economic management of clusters of MMAs.

Based on this analysis, the following recommendations can be drawn:

- Management of MMAs makes both ecological and economic sense;
- Low enforcement efforts substantially decrease the benefits from MMAs. In fact, in the absence of decent enforcement, MMAs have no economic benefits, and their ecological advantages are much lower.
- The very high benefit-cost ratios of proper MMA management suggest that Hawaii should put more financial resources aside for MMA management. If there is not enough political will or priority to do so, a system of user fees should be considered.
- A small user fee would be sufficient to finance the additional costs of proper MMA management.
- Fees can be collected at the sites where implementation of this fee system is most straightforward. Part of the revenues of this system could be used to subsidize the management of other MMAs with few tourists, or in areas where the fee system would be cumbersome or impossible to implement.